# 2 Coordination & Implementation Plan

***What is proposed to meet these needs…***

## *2.1 The Context: Opportunities and Challenges*

The Coordination and Implementation Planning approach was informed by examining the existing GIS conditions in Maine. Based on the research conducted in the GIS Needs Assessment and Requirements Analysis (see Section 1), several opportunities and challenges become apparent:

### 2.1.1 Opportunities

- **Robust GIS data sets exist for the state:** Maine has been pursuing GIS for over a decade and as a result there is a rich, basic infrastructure of existing statewide data sets. Due to these existing resources it will be possible to move Maine forward much more quickly than would otherwise be possible. In addition, these data sets have helped increase the general level of GIS literacy throughout state government, and beyond.
- **Wide state government use of GIS:** Numerous state agencies are effectively using GIS technology on a day-to-day basis. Again, this indicates a high degree of GIS literacy and implies that state government already has much of the expertise necessary to advance the GIS program "to the next level".
- **MeGIS provides an excellent baseline for a statewide GIS program:** The MeGIS program already functions to a large extent as a statewide GIS. While there are undoubtedly some flaws in the current operation and great opportunities for advancement, there is already a successful organization in place. Notably, MeGIS has been proactive and innovative in making its data sets available to the public on the World Wide Web. The fact that MeGIS exists and only needs some tuning, gives Maine a good head start at fulfilling its statewide GIS ambitions.
- **Extremely wide interest in GIS throughout Maine municipalities:** During the extensive interviewing conducted as part of this project there was extremely wide interest in municipalities gaining access to these technologies. It is clear, there is wide support in the field for this type of initiative, and particularly for state support of local/regional efforts.
- **Maine has shown a successful commitment to statewide technology investments:** Maine has a long history of supporting technology investments at the state level. It is clear that the state maintains an excellent foundation for undertaking this type of initiative through both the CIO and BIS offices. The state's innovative InforMe legislation and fine statewide web site are indicative of these efforts. Recently the Center for Digital Government ranked Maine 5$^{th}$ nationwide in effective use of information technology in government during their annual survey of the states.

### 2.1.2 Challenges

- **Unclear funding picture for going to the "next level":** The largest challenge that Maine currently faces is the lack of a clear long term funding picture for advancing the statewide GIS. Clearly, working with the Governor, the Cabinet and the Legislature to secure this funding will need to be a key priority.
- **Protection of privacy:** Many elements of the proposed plan will create and more widely disseminate very detailed information about Maine. This includes data on property ownership and land utilization. In light of general concerns about maintaining web privacy and further homeland security concerns, protection of privacy will need to be addressed without undermining the intent of freedom of information statutes. Privacy concerns are addressed specifically in the plan presented below.
- **Some inter-state agency duplication and lack of coordination:** Given that Maine has multiple, significant but only loosely coordinated GIS efforts there remains some duplication of effort and data redundancy. Given proprietary programmatic interests and long histories among these independent GIS programs issues of asserting increased coordination will need to be handled sensitively and with the goal of achieving consensus. This was recognized by the Legislature and has been partially addressed through the inclusion of two members of the state GIS Executive Council on the Steering Committee overseeing the creation of this report.
- **Wide divergence in sophistication of municipal government throughout Maine:** There is a wide continuum of sophistication and technical expertise among Maine's nearly 500 municipalities. This program cannot proscribe a "one-size-fits-all" program for providing technical assistance to these varied municipalities. As such, the program needs to be crafted carefully so that it provides assistance and benefit to GIS newcomers as well as to long-term GIS users, such as the City of Portland, alike.

## *2.2 Proposal to Create an Expanded Statewide GIS and the Maine Public Library of Geographic Information*

Through Resolve 23, the Legislature requested that a plan for expanding the statewide GIS capability be put in place. To oversee this process the Legislature created a GIS Steering Committee (see frontispiece of this document for a listing of Steering Committee members and their affiliations). Working with state staff and outside consultants the Steering Committee has formulated a multi-element Coordination & Implementation Plan for achieving a higher degree statewide GIS activity, coordination, capability and efficiency. The following presents that plan. This plan aims to address the needs that were discovered and outlined in the Needs Assessment & Requirements Analysis (see Section 1) while considering the opportunities and challenges that are cataloged above.

This plan is anchored by taking action in five separate areas as illustrated by the figure below:

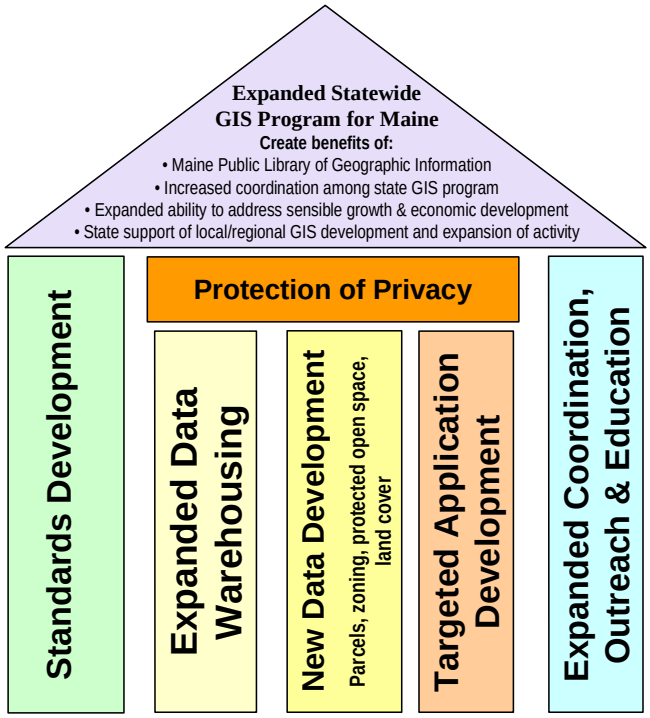


**Figure 2-2: Maine Public Library of Geographic Information: Foundation Pillars**

The hallmark of this plan is the creation of a new entity called the Maine Public Library of Geographic Information (hereafter, GeoLibrary). This new entity will be built on the foundation of advancements made in the five separate areas represented by the pillars of the diagram above. The following describes the proposed activities within each pillar in detail.

### 2.2.1 Pillar #1: Development of Detailed Data Standards

While individual departmental GIS programs as well as MeGIS currently implement GIS standards to varying degrees, additional overall standards development must proceed. The newer standards should expand on existing MeGIS standards and should include both the basic GIS technical specifications (e.g. topologies, clean linework, attributes, etc.) as well as detailed *data layer specific* content standards for important new data sets – such as parcels, open space and land use - that are proposed to be developed (see section 2.2.3 below). These types of expanded standards are absolutely essential of new statewide data layers are to be developed from the myriad efforts of multiple participants. For example, it is contemplated that a statewide parcel data layer will be created over time by the combined efforts all of Maine's individual municipalities. Standards can be

envisioned as the glue that holds these individual efforts together to make them useful at both regional and statewide levels.

Standards will not be nearly as valuable unless there is a firm commitment by the state to **enforce** them. Data created by municipalities must be *tested* to ensure that they conform to the new standards. Ultimately software tools should be created to execute these tests and validate data compliance with these standards. The initial standards document will provide the initial design specification for such validation tools.

Development of these new standards should be pursued as a distinct project under the direction of the proposed GeoLibrary Board (see section 2.3.1 below). It should not be necessary to initiate these activities "from scratch". As described above, Maine already has a start with data standards. In addition, there is a wide body of existing and emerging standards literature from both the federal government and other states involved in statewide GIS. Of particular note:

- **Federal Geographic Data Committee (FGDC):** The FGDC has developed and promoted standards work in a wide number of areas[1]. Of particular note is their widely adopted standard on metadata creation and management.
- **Spatial Data Standard for Facilities, Infrastructure & Environment (SDSFIE):** The National Committee for Information Technology Standards (NCITS) recently adopted this standard as NCITS 353. This standard is robust and comprehensive – including a section on cadastral information - and based on an existing military standard that is already deployed[2]. It is expected that in the wake of the September 11th events that this standard will see increased deployment as numerous entities recognize the importance of being able to "roll up" local data sets into regional views as a tool for addressing issues of homeland security. Maine should strongly consider adopting standards that are consistent with this federal standard.
- **Existing Parcel Data Standards:** Both Wisconsin[3] and Massachusetts[4] have existing parcel data standards that could provide useful reference and guidance for Maine. Similarly, other states may have parcel standards as well as standards for other key data sets such as protected open space or land use/cover.
- **Open GIS Consortium[5] (OGC) Standards:** OGC is actively engaged in creating and fostering both technical data format standards. This body of standards should be referenced prior to adoption Maine-specific standards. In addition, OCG has, or is developing relevant standards for application issues, including standards for geographic object modeling, web map rendering and web services.

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[1] See http://www.fgdc.gov/standards/standards.html for a summary of FGDC standards work.

[2] See http://tsc.wes.army.mil/products/TSSDS-TSFMS/tssds/html/ for further information on SDSFIE.

[3] See http://www.wlia.org/standards.html for further information on Wisconsin standards efforts

[4] See http://www.state.ma.us/mgis/muniparc.htm for further information.

[5] See http://www.opengis.org/ for further information.

### 2.2.2 Pillar #2: Data Warehousing Infrastructure Improvements

It is essential that Maine begin the exercise of collecting ***all*** of its best spatial digital information and then placing it in a location where it is readily available to all agencies as well as to important collaborators and even the general public. This is the essential notion behind the GeoLibrary. In addition, Maine is also hoping to reach out beyond state government and collect important digital spatial data – such as parcels and zoning - from municipalities and regional entities. Certainly those local data sets created with the use of state supplied funds ought to find their way into the central library.

MeGIS currently maintains the beginnings of such a library, also known as a spatial data warehouse. However, the existing data warehouse does **not** have all of the state's best data, much less all data from collaborators and/or fund recipients. In recognition of the fact that as Maine's statewide GIS capacity is expanded additional demands will be placed on the existing data warehousing infrastructure it is essential that Maine plan on improving this infrastructure and planning for staff to handle considerably more data transaction volume. These investments in 21st century "information infrastructure" mimic the 19th and 20th century investments in rail and road infrastructures. The following describes the key initiatives in this area:

#### 2.2.2.1 MeGIS Data Warehousing Improvements

Creation of a stable, high-capacity data warehousing environment is essential for the broader statewide data and data serving initiatives implied by the GeoLibrary. Several areas that must be addressed, include:

- Adding a new staff position for addressing the increased technology of the infrastructure improvements outlined below as well as the increased volume of data transaction implied by increased activity. This new staff person is included in the overall budget presented in Section 5, and is discussed further in sub-section 2.2.5.1 below.
- Planning and consideration of whether the existing ArcSDE™ data warehouse environment should be supplemented by an RDBMS server such as Oracle® Spatial. Tools such as Oracle® Spatial could potentially increase performance and open alternative possibilities for application serving.
- Optimizing the configuration of the ESRI® ArcSDE™ environment. Data warehousing environments involve complex technology and the performance of that technology is the result of careful testing and tuning. It is critical that MeGIS plan on structured optimization and tuning of its data warehousing environment(s).
- In addition to decisions about the underlying technologies (i.e. ArcSDE™ and potentially Oracle® Spatial), MeGIS has choices on the data format(s) with which to warehouse its spatial data. For example, ArcSDE™ supports both generic "SDE layers" and a deployment of ESRI®'s Geodatabase (GeoDB). Development of a complete database design for the data warehouse environment must accompany the optimization and tuning described above. Innovative

existing work using these technologie, such as that being pursued by the DEP, may provide useful models for incorporating into the GeoLibrary.

- All existing MeGIS data sets should be loaded into the data warehousing environment with appropriate metadata. Unlike the present configuration, all data should be stored **seamlessly** on a statewide basis and in a uniform coordinate/projection scheme. In addition, MeGIS staff must ***actively*** work with other departmental GIS initiatives (e.g. DEP, DOT, PUC, IF&W, etc.) to ensure that all the best departmental data is also collected and stored in the GeoLibrary.
- Once the data warehouse is established, the MeGIS staff and the GeoLibrary Board must work on a set of policies and procedures for updating data within the data warehouse. These policies and procedures must cover both technical and administrative/political elements of updating activity, including but not limited to:
  - Assignment of responsible parties (i.e. which departments have responsibility for which layers)
  - Agreement on appropriate timetables for data update cycles
  - Determination of appropriate technologies (e.g. *in situ* updating vs. update outside of warehouse and re-load of updated information)
  - Data standards validation routines to ensure that only data meeting the statewide standards are loaded into the library

#### 2.2.2.2 Evaluate Application Delivery Infrastructure

MeGIS, DEP and others have had extensive experience developing applications using a variety of ESRI®'s tools including ArcView® (Avenue), ArcInfo® (often delivered via Citrix® "terminal emulation") and ArcIMS™. These applications have been developed over time and with varying degrees of success. Many of these applications – particularly some of the older ones - might be more effectively delivered using other technologies (i.e. some Citrix® applications could be done more easily with ArcIMS™). As a result detailed analysis and potentially a plan of upgrade for application delivery should be considered. Key questions include:

- Once the GeoLibrary is in place some/many applications may need to be adjusted to point at the new data warehouse as the fundamental data source, that will deliver the must current, and standards conformant data sets.
- MeGIS and application sponsoring agencies should carefully evaluate existing application architectures to determine opportunities for improvement.
- The GeoLibrary should consider the development of a generic "web services framework" for enabling application development by third parties that can use the GeoLibrary as a data source (see section 2.2.4 below)
- New and existing applications must be carefully designed/optimized for stability and good performance in light of potential increased activity that may arise due to the development of the GeoLibrary. In short, creating the library and the outreach that will accompany the creation of the library may increase the utilization of applications requiring them to be more robust.

#### 2.2.2.3 Internet Bandwidth Infrastructure Improvements

A key component of encouraging data warehousing is ensuring that the people who require access to the data warehouse can obtain that access with appropriate bandwidth. The GeoLibrary will not be successful unless people can get to it with good reliability and performance. MeGIS, BIS and the GeoLibrary Board should evaluate the overall networking environment between state agencies, and between the state and the Internet (where 3rd party collaborators such as municipalities will gain their access to the warehouse) to ensure that there is adequate capacity for the intended purposes. It should be noted that if ArcIMS™ and Citrix® architectures are pursued for application deployment, the need for very high-bandwidth may be lessened to a degree. Both the Citrix® and ArcIMS™ approaches are designed to be bandwidth efficient relative to trying to access full data sets across a wide area network (WAN). Based on the results of this evaluation, the state may consider some potential bandwidth improvements. Ideally, MeGIS should track availability of cost effective broadband Internet access throughout the state and make this information available to municipalities and state personnel planning applications. Currently, no bandwidth improvements are budgeted as part of this proposal, however, this study may indicate a need that would support separate investments in this area.

#### 2.2.2.4 Reevaluation of Current ESRI® Licensing and an Expansion of Group Purchasing Options for GIS Software & Hardware

Statewide, hundreds of GIS software licenses are currently available for use. These are overwhelmingly ESRI® products. While many of these are being used efficiently, there are numerous cases where they are being underutilized. And despite the large number of licenses, there are GIS users who desperately need access to these products and services and can't afford to acquire them.

Maine should strive to optimize licensing with the large software vendors whose products it uses. There are numerous strategies for achieving this, but conceptually it involves pooling license resources so that the maximum number of working 'seats' are available at all times. To this end Maine should strengthen its blanket contract with ESRI®, using the full weight of its pool of licenses as bargaining strength.

The technical move to Citrix® distribution of licenses from a MeGIS central node will support this going forward. If GeoService centers and other GIS users are accessing ESRI® products through this system, more of the licenses in the overall system will be collected for both optimization of availability and bargaining leverage with software vendors.

### 2.2.3 Pillar #3: Additional Investment in Statewide Data Development

Historically, data development is the most costly element of a GIS program. This is amplified when pursuing a statewide project where the land area is very large. The proposed expansion of Maine's statewide GIS reflects this historic trend. Of the potential $14.4 million dollars worth of state and external funding sources proposed for this program, $9.6 million, or 67% is for data development. The following provides details on the data development that is proposed:

#### 2.2.3.1 Creation of Detailed Statewide Orthophoto Base Map Through Continued Participation in USGS NAPP Program

The USGS maintains the National Aerial Photography Program (NAPP) and National Digital Orthophoto Program (NDOP) whereby significant matching funds are provided by USGS to create detailed digital aerial photography for the country. Maine has been a historic participant in this program through a 1997-1998 project[6] created 1 meter resolution, 1":1,000' (1:12,000 metric scale) scale, black and white digital orthophotos (also know as digital ortho quarter-quads, or DOQQs) for approximately 90% of the land area of Maine. Continuing and expanding this relationship is a cornerstone of the data development recommendations. The following outlines specific recommendations for further participation in NAPP/NDOP.

**Completing the 1997-1998 Digital Ortho Quarter-Quadrangle (DOQQ) Project**
Maine should invest in completing the 1997-1998 data set for the entire state. This will create an important, high-quality statewide data set of uniform scale and accuracy. The proposed budget includes payment of $180,000 to USGS that will result in completion of the state. The USGS has notified Maine that if these moneys are not available USGS will proceed with production of the remaining orthophotos on a low-priority basis using in-house resources. However, if the state wants any assurance on completion or control over the schedule of completion, funding will need to be provided.

**Undertaking a New 2003-2004 NAPP Project with USGS**
USGS is now amenable to working with states to create the imagery that will be of most use to the state. Unlike in the past, NAPP funded projects are **not** limited to creating 1":1,000', 1 meter resolution black and white products. The states and USGS can negotiate to specify the aerial photographic products that are deemed to be of most use to the state. There are several opportunities for improvements that Maine is interested in. First, improving the scale to 1":500' and the resolution to ½ meter, will greatly enhance the ability of this type of imagery to be used as a base map by local municipalities. Such a base map is a prerequisite for performing parcel compilations in a consistent, high-quality manner. Second, pursuing color imagery will increase the value of the orthophotos to many constituencies.

The state (likely through MeGIS, the GIS Executive Council and the new GeoLibrary Board) needs to determine specific requirements and work with USGS to craft a detailed proposal for new NAPP imagery that could be flown during the 2003-2004 timeframe (i.e. the next NAPP funding cycle that Maine qualifies for). Since the improvements in scale and resolution will increase the cost of this type of project, it is very unlikely that 100% of the state could be flown and produced for the same costs as the 1997-1998 project. As such, the state may need to consider completing higher resolution imagery for only a portion of the state.

[6] Maine provided funding for the DOQ production aspect of the 1997-1998 project as well as photography funding for a 1991 CIR project.

According to USGS, the state is eligible for up to $1.6 million of USGS matching funds[7] for a statewide project. If the state matches that sum, there is potential to perform a $3.2 million dollar statewide project. According to cost estimates[8] that were made as part of this project, it is possible that $3.2 million would be adequate to fund approximately 70%-100%[9] of Maine's land area for ½ meter color orthophotos at scale of 1":500' (see Figure 2-1 below). If Maine pursued a project where 100% of the state was not covered, then Maine would only qualify for a proportional share of USGS matching funds. For instance, if 75% of the state was covered by a new project, Maine would only qualify for 75% of the maximum USGS match, in this case $1.2 million (i.e. 75% of $1.6 million).

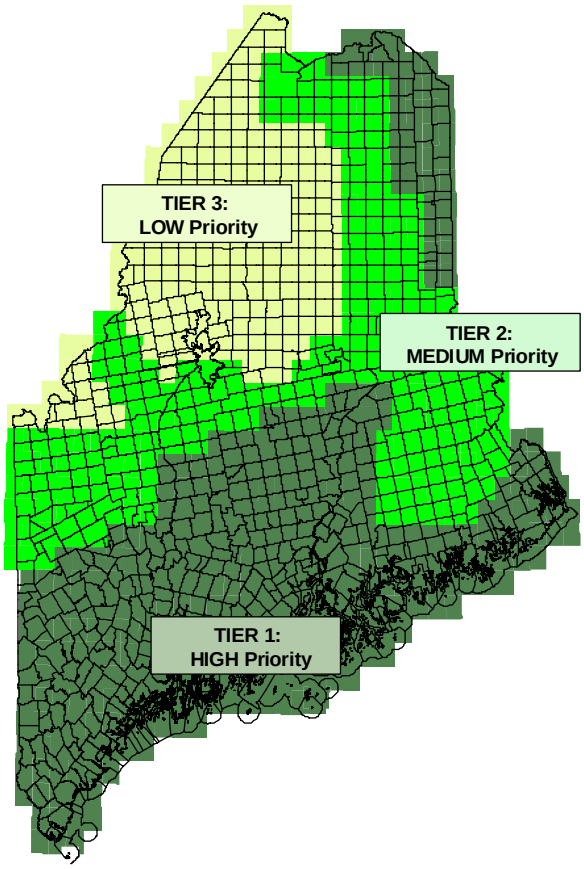
Since vast areas of Maine are unlikely to change significantly in the 1997-2002 time period, it may be possible to craft a program where the most environmentally sensitive and development-susceptible areas of Maine are identified to be flown at higher resolution through a new NAPP/NDOP project. In addition, there is no absolute limit to the funding for this project. Only the USGS contribution is limited. Hence, if Maine were able to raise funds from other sources (e.g. other federal sources, utilities), funding for 100% coverage of Maine under the more conservative cost estimate might be possible. This possibility was assumed in the funding scenario presented in Section 5.

The Steering Committee considered a program that broke Maine into three priority areas for receiving improved, color DOQQs. These priority areas were based on the Steering Committee's impression of the level of need for higher resolution orthophotos (see figure 2-1 below). Higher priority was assigned to areas experiencing higher-rates of change (i.e. development) and perceived increased risks of environmental degradation. As table 2-1 below indicates, based on current cost estimates and an assumed $3.2 million in combined Maine-USGS and potential third-party funding for a statewide project, it should be possible to craft a program that covers all of the "priority area 1 and 2" lands under even conservative cost estimates.

[7] This amount is an estimate only. The USGS can contribute an amount not to exceed one-half the government cost estimate for NAPP photography plus one-half the cost of statewide DOQ coverage based on the USGS fixed price of $800 per DOQ for the state. The number of cooperative partners and USGS funding availability at the time of the agreement will determine the actual contribution.

[8] Several private photogrammetry firms, including USGS NAPP contractors, were contacted and asked to provide price estimates for completing this type of project.

[9] Photogrammetry cost estimates are often presented as a bracket representing a low and high cost estimate. Precise estimates are difficult to obtain prior to detailed specification of a project and absent the competitive landscape of a procurement. In this case, the "low estimate" obtained would be adequate to complete 100% of Maine. The "high estimate" would not.




| Priority Level | % of Maine | Low Est. | High Est. |
|---|---|---|---|
| 1[10] | 48.3% | $1,200,000 | $2,000,000 |
| 2 | 29.3% | $727,950 | $1,213,251 |
| 3 | 22.3% | $554,037 | $923,395 |
| **Statewide** | **100%** | **$2,481,988** | **$4,136,646** |

**Table 2-1: FLYOVER PRIORITIES COST**

**Figure 2-1: FLYOVER PRIORITIES**

### 2.2.3.2 Statewide Landuse and/or Land Cover

Landuse and land cover data are closely related, however, they differ in a fundamental way. Land cover is simply an interpretation of what type of habitat or development is covering the earth. Most often **land cover** is generated based on satellite imagery and the classifications are limited to what distinctions can be made from the raw satellite sensor data. Typically, the built environment classifications are fairly limited and include land cover types such as urban or suburban. Also, land cover data can have very detailed natural environment classifications with distinctions made between many types of forest cover. **Land use** is most often photointerpreted by human beings. As such, there can be a much richer number of built environment classifications with distinctions between high-density residential, low density residential, commercial and industrial possible. Due to the human component of photointerpretation the cost of completing land use is generally much, much higher than land cover. The GIS Steering Committee reached consensus that, given resource limitations, the development of land cover would be more appropriate to meet current analytical needs on a statewide level. The following briefly describes what Maine might obtain through a land cover mapping initiative:

[10] Cost estimates were obtained only for priority level 1 areas (i.e. 48% of the state). These figures were then extrapolated across the other two priority areas. Table figures for percentage were rounded.

A statewide land cover layer would likely be made available in both raster and vector format. Data would be derived from appropriate satellite imagery and classified with an agreed to land cover classification scheme likely containing 20 -50 classifications. Most of these classifications would distinguish different types of natural or agricultural land cover types. In March, 2001, members of numerous Maine and federal agencies established a proposed land cover classification for the state. This comprises more than 100 classes in 4 levels, mostly of vegetation types. The top-level classes are Crops, Grass, Shrub, Forest, Open Water/Wetlands, Coastal, Developed, and Non-Vegetated Non-coastal Manmade. While the specificity of this classification would make it very expensive, the classes established by the committee are a valuable reference source. The contents of this classification are included in this document as **Attachment E**.

Resolution of land cover data that would meet acceptable utility and cost requirements would likely be in the 10-30 meter pixel range. Cost of a statewide land cover classification would vary widely depending primarily on the detail of the data required. As a reference, New Hampshire recently completed a statewide 23-class, primarily vegetation type product over the 9,375 square miles of the state. This took about one and a half years at a total cost of about $250,000.

Commercial off the shelf land cover data are available from vendors such as SPOT Image. SPOT reported that their LandClass 18-classification product could be delivered over the entirety of Maine for less than $90,000.

Maine has an excellent in-state resource for remote sensing data processing in the Maine Image Analysis Laboratory at the University of Maine at Orono. This lab was instrumental in constructing the sole existing statewide land cover layer, assembled in the mid-1990's as part of the Maine GAP Analysis Project. The GAP land cover layer used Landsat-Thematic Mapper (TM) imagery along with other GIS data such as a US Fish and Wildlife Service National Wetlands Inventory (NWI) maps, to delineate 37 different vegetation and land cover types.

#### 2.2.3.3 Parcel Data Layer Development

Parcel data represents one of the most valuable and difficult to assemble data sets proposed to be undertaken by Maine. These data are valuable because cumulatively parcels unambiguously define land ownership across the state. In addition, all addresses in Maine can be associated with a parcel. Thus, parcels also represent a complete, unambiguous data layer of addresses. Since almost all transactions conducted with the state emanate from an address (i.e., of a business, of a tax payer, of a vendor, of a permit holder, of a state office building, etc.), parcels can be used to accurately map those locations. In addition, changes to the parcel fabric of the state are a key indicator of new development and are an important element of development tracking applications and pursuing sensible growth.

Parcel data are extremely difficult to assemble because each of the nearly 500 cities and towns within Maine is responsible for maintaining its own parcel maps. In addition, the parcels in the unorganized territories (UT) are mapped by the Department of Revenue

Services in collaboration with the Land Use Regulation Commission under the Department of Conservation. . Thus, to create a statewide parcel layer, one must assemble and standardize 500 component pieces, plus the information from the UT. Unlike other data sets such as roads, there are no commercial sources for statewide parcel data. Further, the quality and format of the parcel data varies widely from community to community. Last, parcel data are constantly changing since land is continually undergoing sub-division and ownership changes. Assembling and standardizing a statewide parcel data is not a *one-time activity*; it is an *ongoing process*.

As hinted at above, in light of the difficulties assembling a statewide parcel layer, a key component of assembling these data is the creation of clear and strong standards that can be followed by each of these independent entities. If such standards were in place, then it would be feasible for the state to provide grants or other financial support that would result in the creation of parcel data on a town-by-town basis. The standards would ensure that all data were of consistent quality and that they fit together spatially. In addition, the standards should address the collection of minimum set of attribute data pulled from the community's CAMA database (e.g. minimum set might include: owner name, address, land use, assessed value, etc.). It will be necessary to work with the CAMA vendor community so that commercial CAMA software can be tuned[11] to provide the types of CAMA "dumps" that are specified by the standards. The statewide resource would come together over a period of multiple years. The following briefly describes the proposed plan for creating a statewide parcel data layer:

- Proposed budget includes $2 million dollars that would be provided to cities and towns on a dollar-for-dollar matching basis. Cities and towns would pursue data development through their own efforts and contracting with the private sector. The grant program would be implemented under the auspices of the proposed GeoLibrary Board.
- Parcel data would be developed as polygon data layer with an explicit linkage to attribute information (e.g. owner name, assessed value, land use, etc.) available in Assessor's database (i.e. CAMA system).
- Cities and towns would be strongly encouraged to use the existing, or in the future improved resolution, digital orthophotos (DOQQs) as the minimum base map for parcel compilation and automation. Communities that have base maps that are of better quality than the DOQQs would be encouraged to use those base maps.
- Terms of the grant would mandate delivery of the data in conformity to a statewide parcel data standard (see section 2.2.1 above) and allow the inclusion of the parcel data in the publicly available GeoLibrary.
- Terms of the grant would mandate that updates of the parcel data be provided to the state on an ongoing basis.

[11] Tuning might involve adding a feature to the software or having the software prepare a standard report that would generate standards compliant CAMA attributes.

- The grant program would allow "pure" non-matching grants to cities and towns that have already invested in parcel data development. The grants would be used for improving the quality of existing parcel data sets and bringing those data into conformance with the statewide standard.

#### 2.2.3.4 Zoning Data Layer Development

Like parcels, zoning data are maintained at the local level by individual communities. In addition, there are two types of zoning in Maine: 1) **shoreland zoning**, and 2) **general municipal zoning**. Shoreland zoning exists on a statewide basis in reaction to the statewide statute (38 M.R.S.A, Section 435-449) that created these land use restrictions. The application of minimum guidelines requires local discretion to select appropriate zoning designations and create accompanying shoreland zoning maps. In fact, while minimum requirements are uniform, individual communities differ widely in how they implement the minimum guidelines and create their maps. The Board of Environmental Protection imposes ordinance provisions in cases where a municipality has not, in the Board's judgment, met the minimum guidelines.

Even with a relatively uniform statewide program, there are challenges to overcome in developing a composite statewide data layer. Over time, different municipalities have used different wetlands source data. If, for instance, higher accuracy aerially derived wetlands or flagged survey data are used to enhance the accuracy of National Wetlands Inventory polygons, these adjustments aren't automatically adopted as technical delineations. Moving to a new data set requires a full ordinance revision process.

As recently as during the 1990's, DEP offered hand-drafted shoreland zoning mapping assistance to municipalities through a federally funded program. It is unfortunate that this work was not done within a GIS environment.

Conventional municipal zoning does not exist on a statewide basis. Many communities do not employ local zoning at all so "statewide" coverage of this layer is moot.

As with parcels, it is recommended that a strong set of standards be developed for zoning layers in Maine's statewide system. Further, it is recommended that a program for providing grant funding support to municipalities (or regional entities) to create and submit standards compliant zoning data be created. The following briefly describes what a program to develop statewide zoning data sets might look like:

- **Shoreland zoning:** Shoreland zoning areas/buffers would be represented as polygons with attributes describing the zoning classification. The shoreland zoning data from each individual community would be automated and submitted to the state for comparison to the standard and insertion into the GeoLibrary. The issues articulated above illustrate the challenges to be faced in creating a uniform layer using this methodology, but simply warehousing the individual shoreland zoning data sets in an accessible location and common format would constitute a significant step forward.

- **Municipal zoning:** Municipal zoning maps would be automated with zoning areas represented as polygons with attributes describing the municipal zoning classification. Municipal zoning does not have a uniform set of zoning codes from town to town. As such, it will be necessary to "normalize" codes to create a data set that is useful on a regional basis. This normalization would add a new field that rolls up local codes into a "state standard" that approximates the local definition. Implementing this normalized "state code" would **not** involve removing the local "official codes" from the data set. The final attribute table would include two fields: 1) municipal zoning code, and 2) state zoning code. Again, data from each individual community would be automated and submitted to the state for comparison to the standard and insertion into the data warehouse.
- The State Planning Office (SPO) would undertake complementary funding policies that would ensure that **existing** SPO funds used for land use mapping result in standards compliant data sets.
- Grants would be given to municipalities or regional entities such as a county or council of government. These entities would be responsible for developing the data through their own efforts or contracts with the private sector.
- Efforts should be expended to understand the relationship between parcel data sets and zoning. When parcel data exist, or are in the process of being created, zoning automation effort should **follow** parcel automation efforts.
- For the purposes of budgeting, the zoning grant program and the conservation land/protected open space grant program (described below in section 2.2.3.5) are combined as a single budget line item. The GeoLibrary Board working in conjunction with SPO would be responsible for determining the details of this combined grant program.

#### 2.2.3.5 Conservation Land/Open Space Data Layer Development

Currently, MeGIS has a protected lands data set that covers only Federal and State owned protected open space. This layer has been enhanced throughout the past decade by Richard Kelly at the State Planning Office and is reasonably exhaustive regarding state and federal lands at state or regional scales. But gaining a complete picture of protected lands will involve obtaining data on land that is protected at the municipal level or via the very active private non-profit conservation community within Maine. Creating this data set poses many challenges. First, information on locally protected lands needs to be acquired from the multitude of individual communities. Second, there is a large amount of land that is protected via conservation restrictions placed on deeds and this information can be considered sensitive, if not private. Nevertheless, this information is critical and at least two other New England states – Connecticut and Massachusetts – are involved in creating this type of data resource.

The following briefly describes the proposed approach for creating an improved statewide open space data set for Maine:

- **Protected Open Space:** Each parcel of open space would exist as a discrete polygon with attributes describing the owner, type of protection and other key information.
- Grants would be given to municipalities or regional entities such as a county or council of government. These entities would be responsible for developing the data through their own efforts or contracts with the private sector.
- Efforts should be expended describing the relationship between parcel data sets and protected open space. When parcel data exist, or are in the process of being created, protected open space automation effort should **follow** parcel automation efforts. Ideally, the open space parcels would be a sub-set of the parcel representation from a municipal parcel data set. This will clearly be a long term goal given the expected duration of the parcel development initiative.
- As described above, the open space data layer grant program and the zoning grant program have been combined as a single budget line item.

In addition, there is active effort ongoing within multiple agencies interested in creating both Maine-specific and New England-wide open space data sets. The Muskie School of Public Service at the University of Southern Maine is currently undertaking a feasibility study defining the parameters of precisely this question. Other organizations, including the New England Forestry Foundation that secured the 762,000 acre Pingree Forest easement in 2001, are investigating means to achieve the same objective. Keeping abreast of the efforts that are being taken by multiple stakeholders on this front will be critical to avoid redundant development efforts and maximize available resources.

#### 2.2.3.6 Road Centerline Enhancements:

Currently, the E911 road centerline data is the only data set that has comprehensive address information attributes. Similarly, the DOT data set has a rich set of road characteristic and condition attribute information not available on the E911 roads. This project would create a new "combined" data set that would have the best characteristics of each of these two road centerline data sets, while ensuring that the best possible line work representation of roads was used. DOT and MeGIS, working along with the GIS Executive Council have thoroughly examined the feasibility and approach for this project and have arrived at suitable technical approach[12]. This project is ready to go, pending funding availability.

### 2.2.4 Pillar #4: Targeted Application Development

GIS data sets by themselves provide little value. These data must be manipulated by human individuals using software to yield benefits. Often, GIS programs fail to adequately invest in tools for manipulating the data and thus very expensive data are underutilized. As such, it is appropriate for a program of this nature to contain a set of

[12] It should be noted that this technical approach involves the use of ESRI® dynamic segmentation. Currently, dynamic segmentation is not supported in ESRI®'s data warehousing environment, ArcSDE™ . This feature has been promised by ESRI® and DOT awaits its delivery, hopefully on a timetable consistent with completing the road centerline enhancement project.

investments in application tools. These applications will facilitate the use of the data in specific contexts, and to address specific problems. The proposed budget includes $500,000 of investment in applications, or approximately 3.5% of the total 5-year budget. The investment of these funds will help ensure that the other 96.5% of the investments are used early and often.

#### 2.2.4.1 Standards Conformity Validation Applications

As described above in section 2.2.1, standards do not work well unless there is enforcement. Thus, MeGIS will need a set of tools that allows the state to quickly determine if data submitted by a community, or any other collaborating entity, meets the stated standard. If the data passes a "conformity test" then it can move forward in the process for eventual inclusion into the GeoLibrary. If the data does not pass, it should be quickly returned to the supplier, potentially with a report card, so that its deficiencies can be addressed. While automated tools will be important, there will also be a need for accompanying manual quality assurance/quality control procedures.

#### 2.2.4.2 General Purpose Internet Browser-based Data Viewer and an Application Development Platform

With a commitment to creating a superior GeoLibrary with all of the state's digital data, the state should also invest in a set of tools that allows the general public to easily browse the data. This would be analogous to a city or town investing in the creation of a card catalog, or micro-fiche reader once their library was built. The viewer application would be designed to be extremely simple and aimed at the general public. It should not require any foreknowledge of GIS software in order to use it. This application would provide basic GIS viewing capabilities through a web-browser, including, but not necessarily limited to:

- Viewing GeoLibrary data layers
- Providing zoom and pan capabilities
- Providing ability to click on a feature to interrogate attribute data
- Providing an ability to locate an address
- Providing access to, and query of metadata for GeoLibrary layers

Potentially, this type of application could be deployed using a web-services architecture. In the simplest terms, a web service is a web site that generically provides *data to applications* rather than specific *browser content to people*. Hence, the "client-side" data viewer application described above would be designed get its mapping data from a "server-side" GeoLibrary web service. The GeoLibrary's web service(s) would be designed to deliver specific data layers, with specific symbology to the end-user's client viewer application. The client-side viewer application would be designed such that it requested the layers from the server according the specifications of the web service. If the web service was effectively deployed it would be generic and thus the **same web**

**service** could potentially deliver data to the GeoLibrary viewer application as well as to other client-side applications developed by third parties, be they other state agencies or the private sector. That is, *one* server-side web service can power *numerous* client-side applications.

Fueled in large part by E-Commerce, "web service" oriented approaches to computing have rapidly emerged as a topic of intense interest and development. Companies such as IBM®, Microsoft®, Oracle® and Sun Microsystems® have all launched ambitious web service initiatives. Industry initiatives such as Microsoft®'s .NET™ are aimed at facilitating web services development. Currently, there is a great deal of activity aimed at identifying, and agreeing to a common set of standards for web services delivery. The World Wide Web Consortium (W3C) has established an XML Protocols group to develop and codify a set of standards[13] for these services. In addition, GIS firms such as ESRI® have embraced this architecture and are actively improving their products to support these emerging standards. Web services make sense in a GIS context because they can simplify client-side application development significantly.

While detailed planning will remain to be done, it is recommended that the GeoLibrary consider the development of a suite of generic web services. These web services would be accompanied by published Application Programming Interfaces (API) that would allow third-party developers to use these services as a means of accessing data stored within the GeoLibrary. There are at least three critical, foundation GIS functions for which development of a web service may be appropriate:

- Map rendering service
- Geocoding service (i.e. address finding/matching)
- Data download service

Together, this suite of GIS web services would provide a robust application development platform for both the GeoLibrary and third-parties to work with. The proposed browser-based viewing application would be the first application to use these web services. The figure on the following page provides a high-level schematic representation of what the GeoLibrary's services architecture might look like:

[13] The most prominent and relevant of these standards are Simple Object Access Protocol (SOAP); Web Servcies Description Language (WSDL) and Universal Description, Discovery and Integration (UDDI).

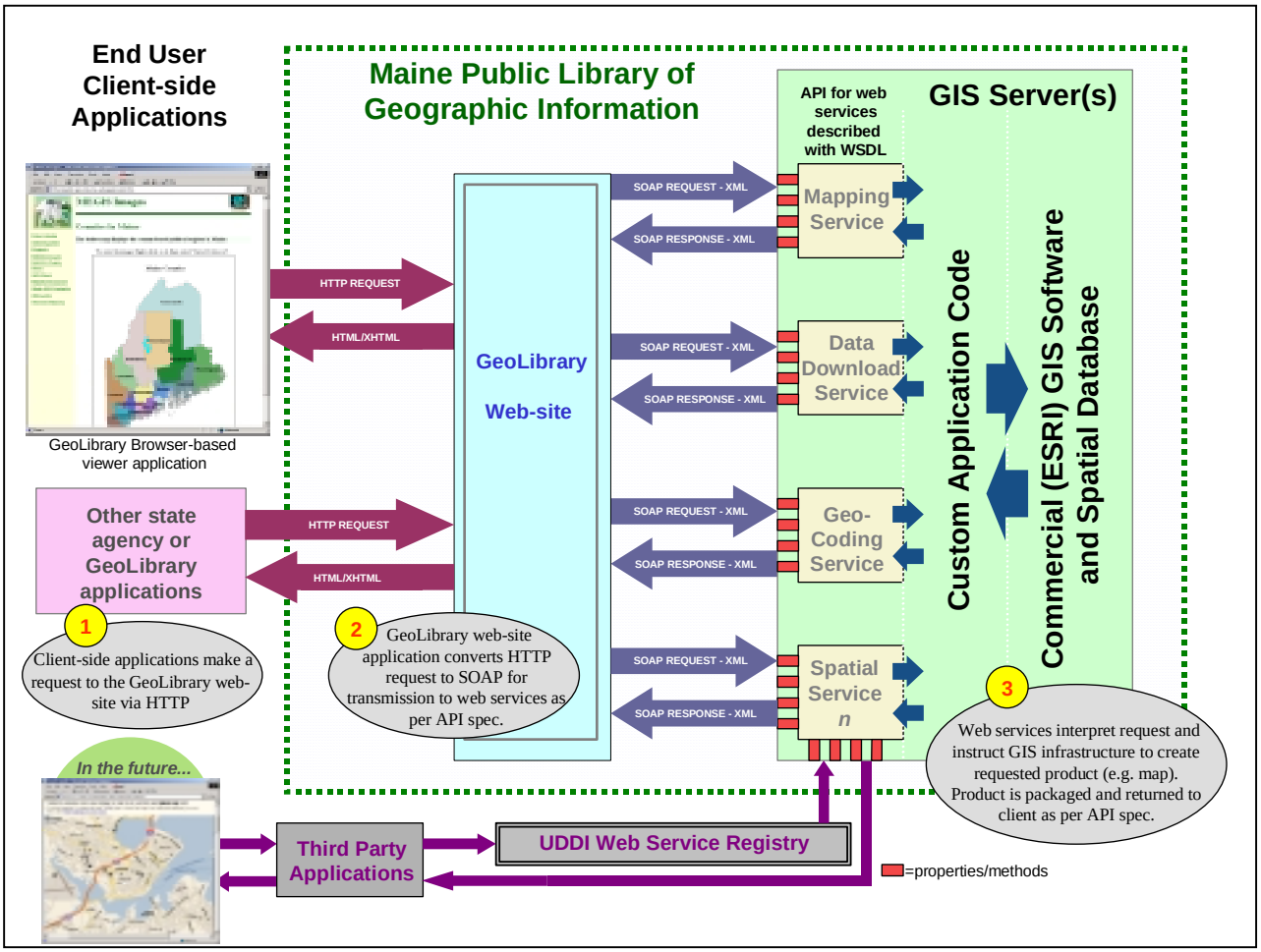



**Figure 2-2: POTENTIAL MAINE GEOLIBRARY ARCHITECTURE**

Additionally, a point rendering and manipulation service should be considered to serve in facilitating Development Tracking applications. This service is addressed in Section 3.

### 2.2.4.3 Development Tracking Tool Development Suite

Performing improved development tracking is a priority for SPO and of significant interest to the Legislature. There are multiple opportunities for using GIS technology to ***measure*** current development, ***extrapolate*** current trends to determine potential impacts, and ultimately to inform policy that will help ***optimize*** future decisions on encouraging growth and development within Maine. In this manner economic development can be fostered while appropriately protecting the environment and unique character of Maine. The details and form of these tools will emerge over time but they may include such things as: completion of zoning buildout analyses and the creation of growth targeting strategies. This initiative and associated applications are fully addressed in Section 3 of this report.

### 2.2.5 Pillar #5: A Program for Expanded GIS Education, Outreach and Coordination

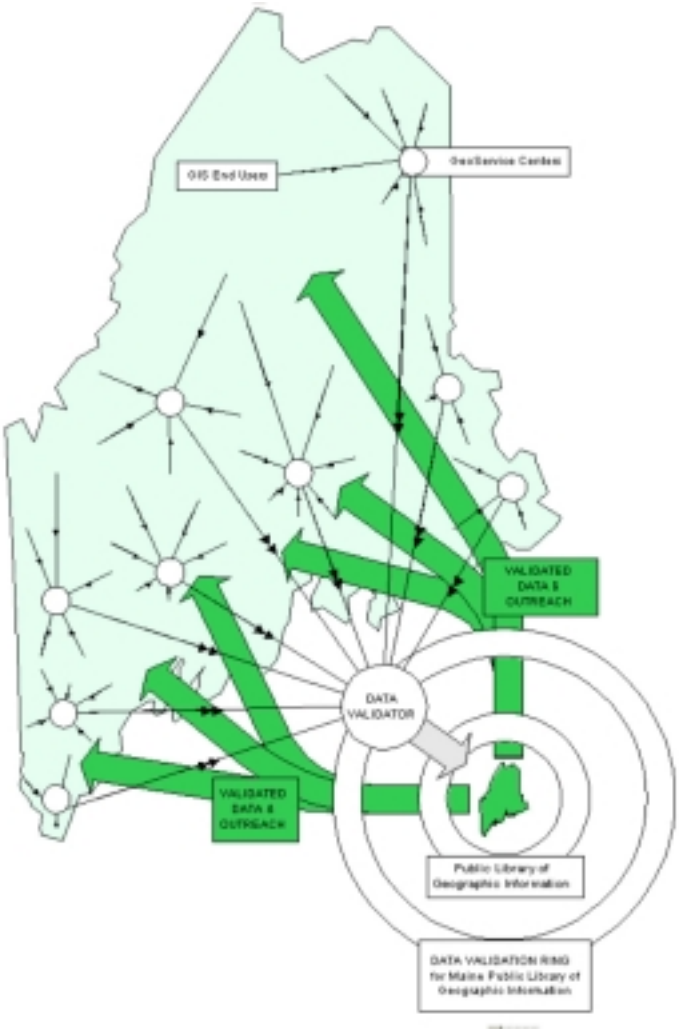
#### 2.2.5.1 Creation of an Explicit Coordination Function within MeGIS:

Many of the initiatives described above involve coordination between the state and the myriad individual communities and regional entities that manage spatial data. Similarly, there are numerous state initiatives, some of which have overlapping data sets and business functions (i.e. the need to distribute data to 3rd parties). MeGIS needs staff resources aimed explicitly at fostering a coordinated approach to GIS development within Maine. The following three staff positions will cover the essential functions of the Maine Public Library of Geographic Information.

- GeoLibrary Content Specialist: manages increased flow of data into and out of the GeoLibrary. Works with current MeGIS DBA. This will be a highly technical position. The Content Specialist will control checkout and check-in of all GeoLibrary data. He/she will be responsible for ensuring that data submitted to the Library meets specifications and integrates fully with overall content. He will track and manage metadata compliance monitor currency and use of Library data. This position is also discussed above in section 2.2.2.1.
- GIS Outreach Coordinator: actively engaged in coordinating both state agency-to-agency and agency-to-municipality/regional GIS activity. The Outreach Coordinator will maintain the best overall sense of who in the state is doing what with GIS data and where particular strengths and most pressing needs are. He will trawl the GIS installations at all government levels and work to get pertinent layers added to the library. The Outreach Coordinator will me the main point of contact with GeoService Centers for technical assistance and training.
- GeoLibrary Contract Coordinator: acts as staff to the board. Looks for grant opportunities and does work of applying for grants. Does contracting for state supported GIS activity (i.e. getting land cover, ESRI® blanket contract, GeoService Center establishment and funding, etc.). The Contract Coordinator will administer the state grant program money, apportioning funding for development of parcel, zoning and open space grant money, for example.

#### 2.2.5.2 Creation of Regional Geographic Service Centers (GeoService Centers):

Obtaining technical assistance frequently and on demand was the most widely reported unmet need during the Needs Assessment interview process. Providing this service, and expanding GIS literacy and utility among a growing user base in Maine will require a support structure distributed throughout the state. Because of the size of Maine and the different issues facing different areas, regional centers are a workable solution for assisting with the delivery of GIS services. Simply purchasing GIS software and data will not create a functioning body of users. To fully enable the use of this technology, regional centers should be established and encouraged. This will assist users with the tools, data and practices necessary to feed Maine's Public Library of Geographic Information (GeoLibrary). The Regional GIS Service Centers (GeoService Centers) will:




- Provide assistance to municipalities without GIS capabilities of their own. Many municipalities are years away from having the capacity to maintain GIS independently. Some will never achieve this capacity. But all should have access to one or more GeoService Centers to ensure that they may receive the full value of the growing Maine GIS infrastructure.
- Answer common technical questions (e.g. how can a data set be projected into the appropriate coordinate system?)
- Assist in Specifying requirements for GIS services and necessary budgets for accomplishing work.
- Execute contracts for GIS work with private sector.
- Understand the fundamentals of the Maine Public Library of Geographic Information. This will include validation requirements for data that has been enhanced or created with state funding in preparation for its inclusion into the GeoLibrary.
- Enforce the Maine geographic data standards as published by the GeoLibrary.
- Foster GIS education. This will include assistance in basic application development and be targeted to Maine issues and Maine data.

Initial GeoService Center activity will likely occur within the eleven existing Regional Councils. These vary considerably in their knowledge and capacities for managing GIS, but they understand the regional mapping needs of their constituent communities and many of the areas where GIS is most needed.

While the GeoLibrary Board will have ultimate discretion in determining what entities qualify as GeoService Centers, it is clear that Regional Councils are not the only candidate locations. Innovative public-private or quasi-private partnerships might be

encouraged as GeoService Centers. The GeoLibrary Board should encourage the creation, evaluation, and renewal of GeoService Centers that best help to meet the goals of this plan. GeoService Centers should be evaluated on their ability and capability to reach a broad range of public and private interests and in meeting the purposes of this plan and the GeoLibrary.

Land trusts or large municipalities with established GIS and excess technical capacity could serve in this role, especially in areas where regional councils are not technically qualified to provide these services.

Private companies might also be able to serve as GeoService Centers. Two of the primary contractual obligations of GeoService Centers will be enforcement of spatial data standards and providing technical support to GIS users. In many cases strong relationships already exist between private firms and client GIS users. Development and maintenance of these systems benefit significantly by strong, ongoing interpersonal relationships, and where these already exist the GeoLibrary should seek to strengthen them.

Private rates for performing GIS work will likely be higher than those charged by regional councils, but experience has shown that this will not price the private sector out of the market. The private sector has a much more nimble capacity to scale services to needs and adjust quickly to changing circumstances, and if initiatives in southern New England are any indication, it will be essential to have such excess capacity available in the GeoService Center community. A public-private partnership of this sort should foster a lively development environment for innovative approaches to problem solving.

## *2.3 Implementation Issues*

### 2.3.1 Governance and The Maine Public Library of Geographic Information Board

Recognizing that an ongoing governance structure is vital to the successful implementation of the recommendations outlined in section 2.2, the Steering Committee collaboratively developed, and unanimously endorsed draft statutory language to establish the Maine Public Library of Geographic Information and a governing Board. (**See Attachment F** for a copy of the entire draft.) If enacted, the Library will be charged in statute to serve the needs of citizens, businesses and all levels of government, by providing a standardized, networked clearinghouse of all geographic information available for public use within Maine.

In overseeing the Library, the Board will work in partnership with municipal and county data custodians to provide electronic copies of all geographic information produced with State moneys to the Library. In addition, to reduce redundancies in the creation, verification and maintenance of public geographic information, State agency data custodians will provide the Library with electronic copies of geographic information funded by any source of public funds or grants. Federal agencies and private organizations may also volunteer data to the Library. The draft legislation

specifies that organizations, which submit information to the Library for public use, will not be held liable for any use of that information. While the Board may develop appropriate internal services to facilitate generalized access and use of Library data, the Board will not compete directly with services provided by private enterprise.

The Maine Public Library of Geographic Information Board's 15 members represent stakeholders from State agencies, counties, regional councils, municipalities, public utilities, and private sector GIS vendors. The University of Maine, environmental, real estate and development interests, and the public are also represented on the Board. The President of the Senate, the Speaker of the House and the Governor each appoint members to three-year terms. The Board will oversee Library operations; establish and maintain standards, rules and policies regarding data to be placed in the Library; coordinate public geographic information; set priorities; approve expenditures of funds; seek partnerships; resolve disputes; conduct studies; and report annually to the Legislature. With respect to standards and policies, the Board has broad powers. If the draft legislation is enacted without change, the Board will set standards and policies regarding:

- Methods of access and delivery of information held by the Library,
- Geographic Information System technical specifications,
- Data content, metadata, and security including guideline criteria for accepting third party data from data custodians or data volunteered by the private sector,
- Privacy and how it will be protected,
- Mechanisms to correct inaccuracies, and
- Data validation tools and processes.

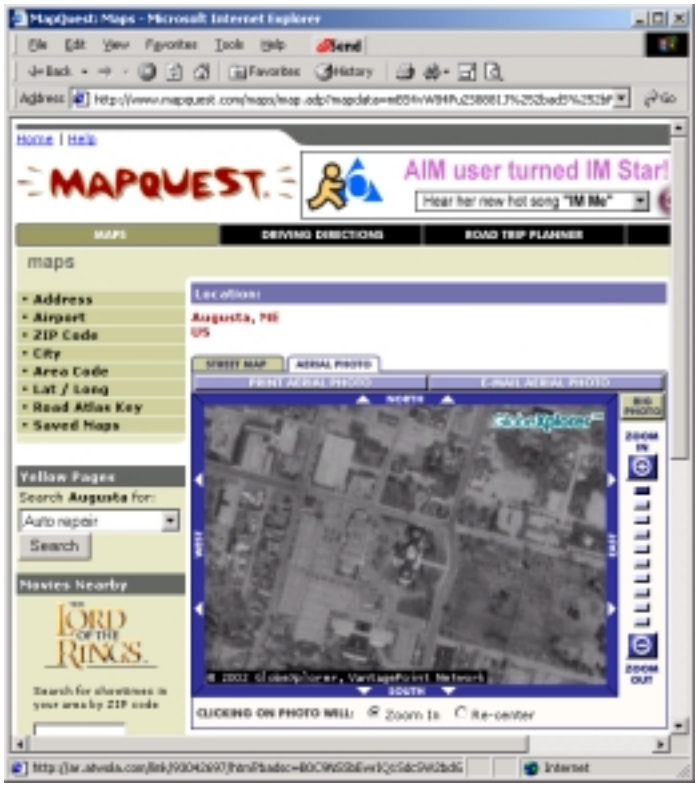
The draft legislation also authorizes the Board to establish fees for electronic copies of Library data that are not more than three times the actual cost of reproduction. Lastly, it specifies that the presence of data in the Library does not, by itself, make that information a public record.

Finally, it is important to recognize that the new Board is responsible for GIS on a statewide, inter-governmental level. It is anticipated that the new Board will work closely with existing coordinating bodies, such as the GIS Executive Council, which represents state government interests. The GIS Executive Council will be a key ally for helping to expand GIS in Maine and in helping the Board implement policies as they pertain to state government agencies.

### 2.3.2 Protection of privacy

With increasing adoption of the World Wide Web and in light of security concerns raised in the aftermath of September 11$^{th}$ there is legitimate, increased attention on preserving privacy in the digital age. More information is more readily available than ever before. Pursuing an expanded statewide GIS and the development of the GeoLibrary raises important questions of whether privacy is compromised by creating and facilitating the

distribution further spatial data layers. As such, the Steering Committee created a sub-committee to examine these issues and this report reflects the findings of that sub-committee.




It is clear that the state's spatial data, whether in digital or hard copy format, is part of the "public record". Hence, almost all[14] of the data sets under discussion are public documents that can be accessed by the general public. No new privacy issues are raised simply because the public records in question happen to be maps.

In addition, there is already wide spatial data availability through publicly available commercial sources. For example, the figure to the left shows an aerial photo image of the Maine State House complex taken from the publicly available, free MapQuest.Com site. While these types of data sources have different content and quality than what is being discussed for the GeoLibrary, the fact remains that it is already relatively easy to locate detailed spatial data for Maine via the web.

While agreeing these are public records, the sub-committee also discussed potential mechanisms that could be added to a web-based distribution of GeoLibrary content. These mechanisms include, but are not limited to things such as a request for "opt out" of one's records or the wholesale suppression of certain types of information such as property owner names. Web based technologies provide multiple options for instituting these types of privacy protections. In addition, web server technologies provide tools for assessing the computer connections that are looking at various data sets. For example, Maine's InforMe system tracks users of their system and can gain a general sense of "who's looking at what". Such tracking can help identify suspicious or inappropriate usage of the system while also allowing the serving organization to better understand what types of services are most in demand.

The burden of responsibility for determining privacy standards rests with the original data custodian and privacy will be one of the details contained within the Memorandum of Understanding governing the data transfer agreement between original custodians and the

[14] There are a limited number of data sets, such as the location of endangered species habitats or archaeological sites, which have statutory exemptions from Freedom of Information statutes.

GeoLibrary. The GeoLibrary, in turn, must ensure that only necessary and appropriate information is made available to the public. The concern is neither new nor unique to geographic data. In fact, the State has significant experience with suppressing certain fields of data within public records (e.g. taxpayer and sales tax records) and has already successfully addressed the privacy issue from a shared portal environment similar to the GeoLibrary through the InforMe Board.

Ultimately, the Steering Committee has confidence that appropriate safeguards on privacy can be instituted through the GeoLibrary. It is recommended that the newly formed GeoLibrary Board undertake the development of a specific privacy protection policy, and a plan for implementing that policy.